

Reply to reviewer 1 regarding revised manuscript

Meteorological factors controlling low-level continental pollutant outflow across a coast

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We would like to thank the author for his/her helpful comments on the paper. They are addressed in turn below.

Specific Comments

Section 2.2: We have re-written this section and split out two paragraphs discussing other studies using the same data so that they now appear after we have discussed our results.

1.425: Yes, ozone is deposited directly into sea water. Section 7 of Fairall et al (2006) describes the semi-empirical relations that are typically used to describe the rate of ozone deposition in terms of the solubility of ozone in sea water and the molecular diffusivity of ozone in sea water plus some other parameters. They used the ICARTT data to estimate an average ozone deposition velocity of 0.4 mm/s from turbulent flux measurements across the Gulf of Maine during the ICARTT campaign. This value is typical of that employed in chemical transport models in parameterisations of deposition.

Perhaps the word “dilution” is causing confusion here. We were talking about decrease in mixing ratios with time. In an air mass with higher specific humidity, the rate of photochemical processing associated with the OH radical increases. Many species are subject to faster photochemical loss (e.g., alkanes) and the photochemical system tips into one dominated by photochemical destruction of ozone once the precursor species are sufficiently depleted by reaction or mixing with cleaner air. We do not suggest that the presence of water vapour changes boundary layer mixing.

This paragraph has now been written more carefully to make clear the processes acting.

End of Section 2.2 (1.439 rather than 490): At the location of the flights on the days studied (20-22 July 2004) the marine boundary layer was deeper than usual associated with the passage of a cold front. The MBL depth at this time is almost 1km which explains why the chemical species are mixed across this depth and mixing ratios decrease above.

The paper quantifies all outflow across the coast and partitions it into the mass within and above the MBL. The abstract and Introduction have now been modified to make clear that all outflow across the coast is studied, although the term “coastal outflow layer” is reserved specifically for the layer between the top of the MBL and H_{max} . In the simulations for the East Coast USA, the tracer in the coastal outflow layer was more than three times that in the MBL (without accounting for loss by deposition and faster reaction).

1.92: words changed

1.227 (rather than 281): words changed

1.280: words changed
1.311: changed to “most interesting behaviour”
1.319: words changed
1.320: reference for CO lifetime added
1.322: words changed
1.325: words changed
1.396: changed wording removing “to leading order”
1.432: sentence re-written as part of the re-arrangement of Section 2.2.
1.435: sentence regarding long-range transport is qualified by referring to the retention of a distinction hydrocarbon footprint of each air mass, as shown by Methven et al, 2006.
1.897: words corrected